

Preparing an AstroSat Observing Proposal

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Why do we write proposals?

At least three reasons:

- Good scientific problem in hand that requires new data for further understanding or solution of the problem.
- Funding
 - Successful proposal may help in getting funds
- Improve Job prospects
 - A record of successful proposals improves chances for getting faculty jobs

Why do observatories require proposals ?

- You have an excellent scientific idea, why not just observe?

A large number of people also have excellent ideas and the resources are limited.

Space-based astronomical instrumentation and operation are very expensive. Proposals are needed to ensure that the best science is done with a given observing facility.

- Through the proposal system, observatories select the best of scientific ideas that are best suited for new observations.
⇒ Strong competitions for the limited available observing time leading to significant over-subscription

Over-subscription Factors

$$\text{Oversubscription factor} = \frac{\text{Total requested observing time}}{\text{Available observing time}}$$

- XMM-Newton, Chandra, Suzaku ~ 5-10 (Typical)

Example: XMM-Newton AO-10

491 valid proposals requesting 89450ks of observing time.

Available time for distribution : 14500ks,

over-subscription factor = 6.2.

⇒ Most proposals are rejected!

(Small number of successful proposers. Others call it a lottery!)

- AstroSat ~ 2-2.5
- Small optical telescopes ~ 0.5-2

Announcement of Opportunity (AO)

- Space agencies or observatories release a letter to the scientific community inviting observing proposals for a given cycle. This is called an Announcement of Opportunity.
- **AstroSat 9th AO cycle Announcement** (for observations in the period April 1 – September 30, 2020)
 - Out of 87% time available, 55% Indian PIs, 20% time for International PIs, rest for calibration, ToOs.
 - Proposal submission deadline: 5PM on 14th November 2019.

Read the document for policy

https://www.isro.gov.in/sites/default/files/ninth-ao-procedures_v022.pdf

Proposal Types

- Available Proposal Types (for AO, GT cycles)
 - Regular Proposals - Consisting of one or more targets and single observation of each target
 - Monitoring Proposals – Repeated observations of a single target
 - Anticipated ToO proposals – Target of Opportunity which is foreseen.

- Scientific Category
 - Soar System, Star & Stellar System, Compact objects in Binaries, SN, SNR & Isolated NS, Diffuse emission – Galactic & Extragalactic, AGN & quasars, Surveys, Galaxies, Cosmology, Other (.....

Planning a Proposal

Before writing a proposal, plan your proposal.

- **Test your proposal idea**
 - Discuss with others, particularly with your Co-Is and convince that the idea is interesting and important.
 - This will help in formulating the proposal.
- **Check Archives for similar existing observations** (Check AstroSat **Red Book**)
- **Familiarize yourself with the instruments**
 - Read Technical manuals, understand capabilities & limitations
- **Read & understand instructions for proposers**
 - Proposal policies, page limits, submission software, proposal preparation tools, etc. **Read AstroSat Proposer's guide available at ASSC.**
- **Feasibility Study**
 - Estimate S/N ratio, exposure time requirements, check visibility, other facilities?, etc.

Planning an AstroSat proposal (for observations with UVIT)

- Scientific problem in hand
 - Suitable Target(s)
 - Is the target visible to AstroSat?
 - Visibility constraints : (w.r.t. to pointing direction)
 1. Sun angle > 65 deg
 2. Moon angle > 15 deg (for UVIT) or > 0 (X-ray SXT/LAXPC/CZTI)
 3. ram angle (between velocity vector and pointing direction) > 12 deg
 4. angle from Earth's limb > 12 deg
-

Planning an AstroSat proposal

- Is the field containing the target safe for UVIT?
- Scientific feasibility : S/N calculations, simulations, required exposure time in safe filters/gratings
- Start preparing the Proposal
 - Scientific and technical justification
 - Proposal form, target details, instrument configuration, attachments, verification, submission

Proposal Structure

Two Parts:

- Cover Sheet or proposal form or General form
- Scientific (& Technical) Justification - [A mini-paper](#)

Cover Sheet or Proposal form

Prepared with the help of APPS: <https://apps.issdc.gov.in/apps/auth/login.jsp>

- Title, abstract
- PI, Co-Is information
- Proposal type
- Scientific category
- Target List (name, coordinates, fluxes), exposure times, time constraints, etc.
- Instrument configurations
- Attachments

Familiarize yourself with the web-based APPS form quite in advance.

Scientific Justification

(Most important part in the proposal, **4 pages long**)

1. **Title** – Suitable attractive title. An example

“Determining Black Hole Spin in the narrow-line Seyfert 1 galaxy Akn564”

2. **Abstract**

- Clear & Concise (150 words for AstroSat)
- **Only information that all reviewers will read**
- An example

“We request a long 130ks XMM-Newton observation of the narrow-line Seyfert 1 galaxy II Zw 177. The existing short XMM-Newton exposure has suggested a relativistic broadened iron K line with a red-wing extending down to 4.5keV. **The proposed long observation can not only confirm the existence of relativistic disk line but also determine whether the black is spinning or not.** Furthermore, the short observation suggests the possible presence of a QPO at $\sim 9 \times 10^{-4}$ Hz, which can be confirmed by the proposed long observation.”

Scientific Justification

1. Title

2. Abstract

3. Background & Motivation

- Why is this science interesting and important?
- What are the open questions in the particular area?
- Bigger picture?

If the first page is not interesting, the proposal is unlikely to be graded high.

Scientific Justification

1. Title

2. Abstract

3. Background & Motivation

4. Objectives with AstroSat

- What science exactly you are going to do? Primary objective & Secondary objectives?
- what actually is going to be observed and what will be extracted from the proposed observations using ASTROSAT.
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Scientific Justification

1. Title
2. Abstract
3. Background & Motivation
4. Objectives with AstroSat
5. Scientific Feasibility and Justification for the requested observing time
 - Choice of targets
 - Requirement of exposure time
 - Expected count rates, S/N?,
 - Demonstrate by simulations that you will get the desired results if the observation is performed.
 - show that stated science goal can be achieved with simulations.

Scientific Justification

1. Title
2. Abstract
3. Background & Motivation
4. Objectives with AstroSat
5. Scientific Feasibility and Justification for the requested observing time
6. Report on previous successful AstroSat proposals by PI if any
(New section in cycle A09)

Provide a brief description on the status of observations, data availability, data analysis and publication based on previous successful proposal(s) by the PI.

7. Most relevant refereed publications by the proposers
(Science Justification : 4 page limit)

Proposal Preparation Tools

- **AstroSat WebPIMMS – count rate calculator** http://astrosat-ssc.iucaa.in:8080/WebPIMMS_ASTRO/index.jsp
 - PIMMS can start with measured count rate with another instrument (e.g., Einstein IPC , ROSAT PSPC, etc.) and predict the count rate for AstroSat X-ray instruments.
- **UVIT Exposure Time calculator** <https://uvit.iiap.res.in/Software/etc>
- **Spectral Simulation/fitting Tools - XSPEC, ISIS, Sherpa**
 - Simulate Complex spectra, estimate exposure time, find expected accuracies of spectral parameters
- **Temporal Simulation Tools**
 - **LAXPC event list simulator (Talk by Jayashree)**
 - **Simulate lightcurves given a PSD with QPOs, breaks!** (Timmer & Koenig (1995): "On generating power law noise", A&A 300, 707-710)
 - **IDL, ISIS, or your own code**

Data to be used in proposal preparation

- Use recommended responses and background data files

OR

Get these data from a recent observation with the same instrument in the same configuration.

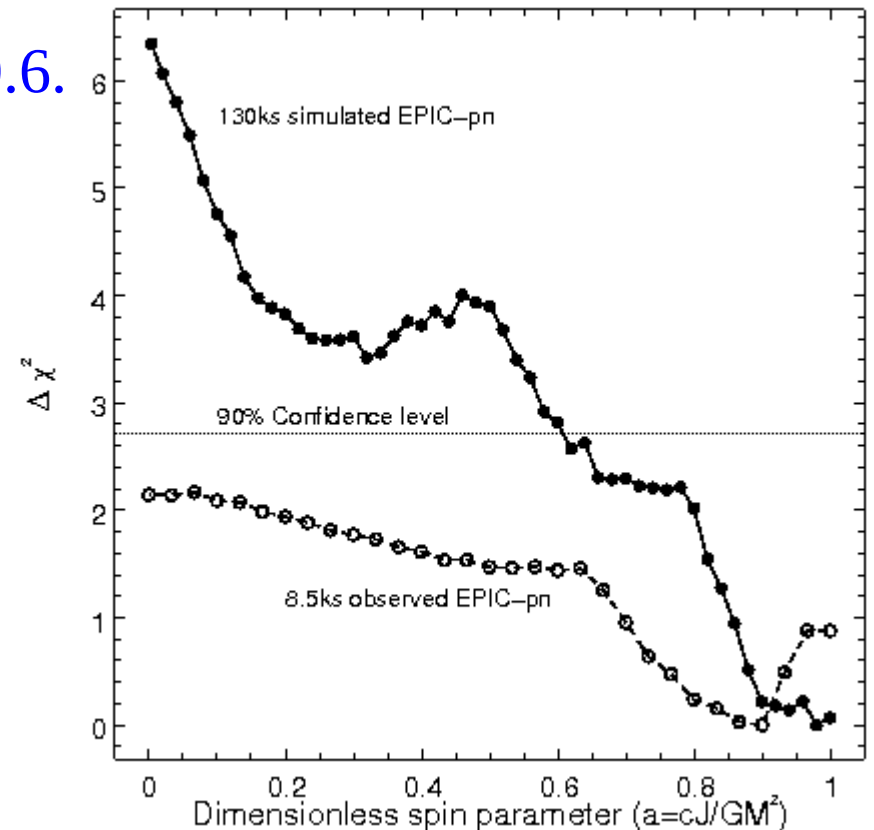
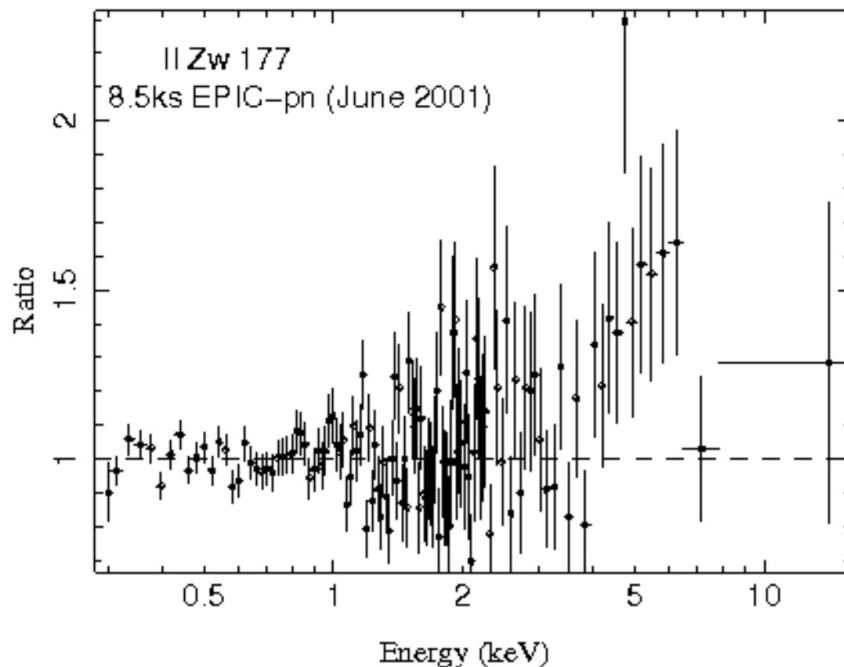
Estimating Exposure Requirements

- Estimate count rate for a given instrument – PIMMS, UVIT exposure time calculator
- Estimate total counts required (depends on science)
 - Example: You want to measure continuum shape in the 0.1-10 keV band. Spectral resolution $\sim 200\text{eV}$ (FWHM)
Total counts ~ 50 bins $\times 3 \times 20$ counts ~ 3000 counts
- **Next level of detail - Simulate the spectrum with XSPEC or other simulation tools.**
 - Should provide sufficient insight to the expected spectrum.
- **Fit the simulated spectrum & quote the accuracies of the spectral parameters which you will be able to measure**

Exposure time should be as short as possible to fulfil the scientific requirement

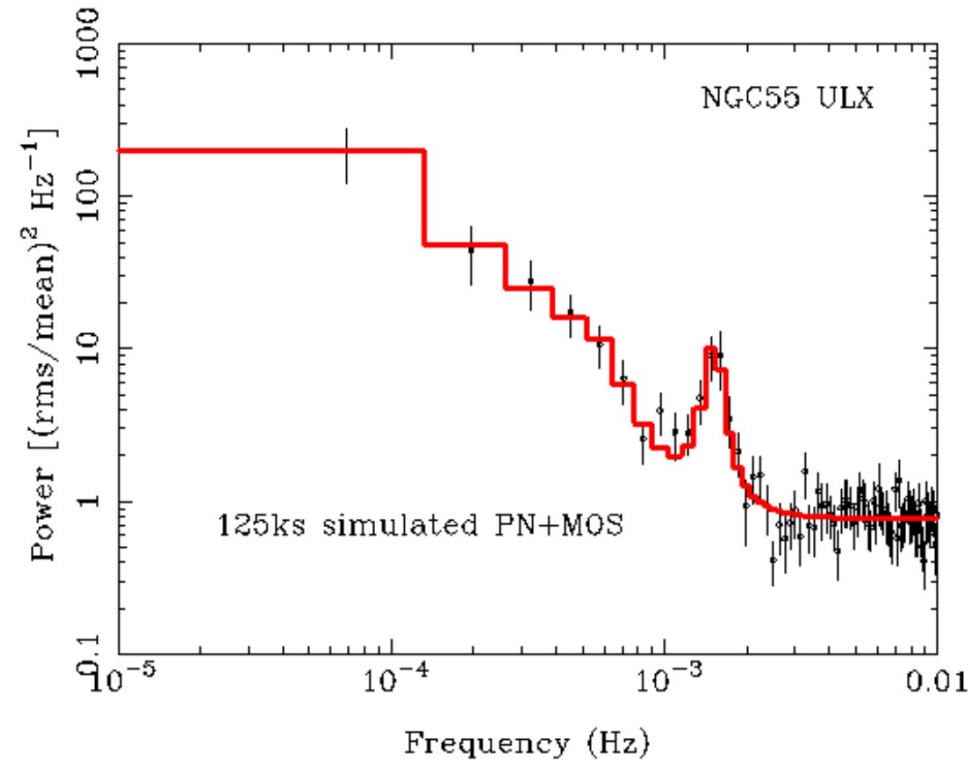
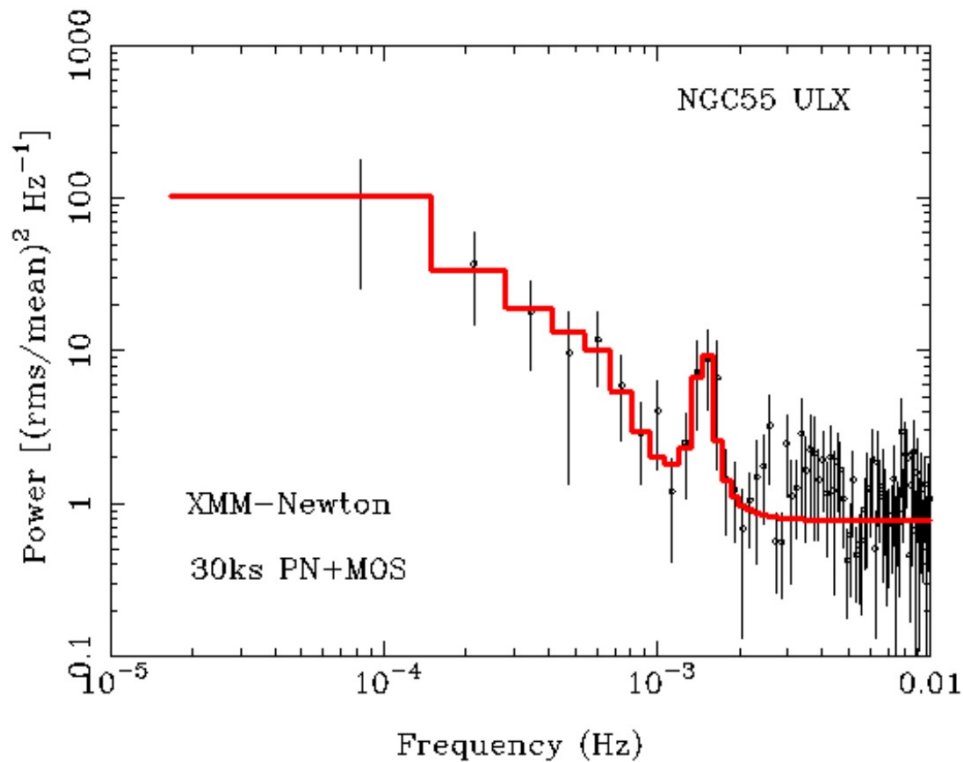
Scientific Feasibility

- Demonstrate that the proposed science goal is achievable
- An Example from a proposal accepted for XMM-Newton observations
 - At 90% confidence, the BH spin parameter can be measured to be $a > 0.6$.



Scientific feasibility

- **Another example** : QPO from an ULX in NGC55
(Accepted for XMM-Newton observation in 2010)



If the observed QPO is real in 30ks XMM observation, it would be detected with >99.9% confidence level in a 125ks long observation

Technical Feasibility

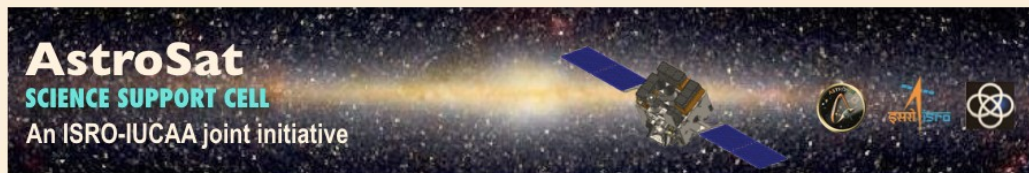
- Target Visibility
- Instrument safety
- Time constraints (User imposed)
- Coordinated observations
- Flux limits imposed by instrument teams

Technical Feasibility

- **Target Visibility:** Number of factors that limit observation of a target
 - Passage through Earth's radiation belts, SAA
 - Ram angle constraint
 - Sun avoidance angle
 - Moon avoidance angle
 - Bright earth avoidance
 - Roll angle constraints (angle of rotation of view axis)
 - Spacecraft and instruments designed to take advantage of the observatory having hot and cold sides, leading to constraints on the roll angle

Technical Feasibility

- **Target Visibility:** Use AstroSat visibility tool
- Use Avis Online Tool (Jayashree & Shah Alam)
<http://astrosat-ssc.iucaa.in:8080/AstroVisCal/>

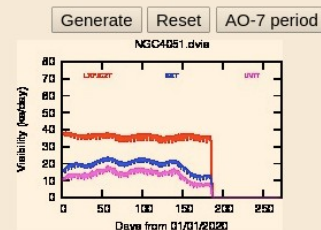


ASTROSAT VISIBILITY CALCULATOR

Settings ⚙

TARGET NAME	RA [J2000]	DEC [J2000]
<input type="text" value="NGC4051"/>	<input type="text" value="12 03 09.60"/>	<input type="text" value="+44 31 52.6"/>
+		
START TIME :	<input type="text" value="01-01-2020 00:00:00"/>	
END TIME :	<input type="text" value="30-09-2020 23:59:59"/>	

← 01-03-2020 00:00:00



[Download Plot](#) [Download Files](#)

Technical Feasibility

- **UVIT safety (Kanak's Talk)**

- Read the document “Mandatory checks to be done for UVIT observations” available at ASSC site http://astrosat-ssc.iucaa.in/uploads/APPS/Guidelines_for_proposal_submission_8.pdf

- **VIS Filter Check Tool**

- <http://uvit.iiap.res.in/Software/theia/>

- Choose the VIS filters such that none of the stars give > 4800 c/s

- **FUV Filter Check Tool**

- <http://uvit.iiap.res.in/Software/gaia/>

- Choose the FUV filters such that none of stars give > 1500 c/s

- If Galex image not available for the full UVIT field

- If the target is outside Galactic latitude of ± 30 degrees

- Use TD1 catalog to establish UVIT safety

- Else if the target is within Gal latitude of ± 30 degrees

- Cannot be proposed as a regular or monitoring proposal

- Propose as AToO proposal, also requires a UVIT safety ToO proposal before or after the proposal deadline.

- See Proposer's guide for details.

- **FUV Grating safety Check**

- Use if count rate in FUV CaF2 is less than 892 c/s.

Technical feasibility

- Time constrained (User imposed)
 - Example : Observation in particular phase of periodic source
 - Puts constraints on the operation of the satellite
 - More difficult to be accepted
 - Strong science justification required

Note : Do not specify time constraints due to visibility window

Technical feasibility

- Flux limits for X-ray Instruments
- LAXPC: Fainter than < 2 Crabs.
- SXT data will be severely piled-up if there is a very bright optical source with V magnitude less than about 4 magnitude.

Targets not satisfying these criteria will be rejected.

Technical Justification

pdf file, limit 2 pages

- **Type of proposal:** Regular pointing or Monitoring or Anticipated ToO - please pick one only

- **Is this a time-constrained proposal :** YES/NO

- **Information on Time constraints if applicable**

Reason for Time constraints : For example: Coordinated observations with other observatories: ground based/space based ? or due to anticipated events or opportunities ?

Dates and duration of the time constraints -- preferably in a tabular form.

Are the time constraints consistent with the Astro-viewer outputs: Yes/
No

- **Monitoring frequency if applicable:**

Technical Justification

pdf file, limit 2 pages

- **Safety concerns with regard to the UVIT**

Please specify which of the UVIT exposures can be avoided without affecting main scientific objective of the proposal: FUV / NUV & FUV / NUV / NONE (Pick one of the options.)

- Is the astroviewer output generated by setting the "Roll-moon vector angle" to 15~degrees? : Yes/No
- Is the field for each target requiring UVIT observations checked for safety concerns as per the recommendations in the document "Mandatory checks to be done for UVIT observations"? : YES / NO
- Whether a pdf document with details on UVIT Bright Sources within and near the UVIT field of view as per the document "Mandatory checks to be done for UVIT observations" is attached ? : Yes / No

- **Any other information related to technical safety or feasibility**

Attachments

(In pdf format)

- **Science Justification** (4 pages or less)
- **Technical Justification** (1 to 2 page)
- **Astrosat visitibility** (Plot generated from Avis tool) or the output of Astroviewer
- **UVIT Bright Source list**
 - Merged output from VIS and FUV filter check + any other information such info on nearby bright source, Galactic latitude, justification if Galex image is not available
 - You can print the screen output in pdf format and then merge.

HelpDesk: astrosathelp@iucaa.in

Tips & Tricks

- Check archives, analyse the related data, avoid already accepted/scheduled targets unless there is strong science justification
- Respect page limits, font sizes and other regulations
- Referees may have to read a large number of proposals. Referees may be non-specialists
 - Keep the proposal simple. Minimize acronyms, avoid jargon & complex language.
 - Use short sentences.
 - Ask your colleague to read your proposal
- Come to the point immediately. Be clear and explicit in what you say.
 - Use boldface in a few places to emphasize an important point.
- Be consistent – use the same numbers for repeated quantities

Thank You